An apple-based screening aid for congenital dislocation of the hip

AN APPLE-BASED SCREENING AID FOR CONGENITAL DISLOCATION OF THE HIP

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Congenital Dislocation of the Hip, or C. D. H., is a condition that a child can be born with, or develop shortly after birth. If detected early, treatment is simple, painless and almost totally effective. However, a late diagnosis made when the child starts to walk necessitates several operations with no guarantee of success.

Using two clinical tests, Barlow's and Ortolani's, the operator can detect at birth, hips which are likely to dislocate. The hip produces a palpable transient vibration or "clunk" as it moves in and out of joint. A higher frequency vibration is also produced by a different phenomenon called cavitation. The experienced operator can detect these but, because of subjectivity, they are often missed or confused by less experienced medical staff.

This paper describes the hardware and 6502 machine code used in a measurement system to record joint vibrations during clinical testing of the neonatal hip.

Initially, an analogue detection, capture and display apparatus, based on small vibration sensors and a frequency modulated tape recorder was used to gather sample information on both transient vibrations[1]. Using this as a guideline a microcomputer based system was designed to reduce size, cost and complexity. Both software and hardware were developed to convert an Apple II microcomputer into a vibration data logger. The "C. D. H. Screener" as it is called, allows the operator to capture up to eight seconds of vibration information from three transducers placed on bony prominences around the pelvis. This information is stored on a 128kbyte extended R. A. M. board, and later displayed sequentially under keyboard control. The user may optionally use a feature search routine to speed processing.

The analysis techniques for joint vibration previously described[2] have been considerably simplified since the expcnential fit to the transients and integration of the signal have been shown to be of little value in differentiating the joint vibrations.

Present inbuilt analysis routines allow the operator to "window in" on transient data which is used to calculate window size and peak to peak amplitude. A fast Fourier transform enables calculation of both the peak and weighted mean frequency for this data. A hard copy of the test results from a dot matrix printer include both the time and frequency plots with the four calculated parameters.

A large clinical trial is underway at present to evaluate the screener

and to correlate the time and frequency parameters with clinical findings. Further developments will be outlined as the system becomes commercially viable.

REFERENCES

1. R. A. B. Mollan, Barbara A. Bogues, and G. H. Cowie. A New Aid in Screening for Congenital Dislocation of the Hip. Health Visitor, August, 1983, Vol. 56. 285-287.

2. W. G. Kernohan and R. A. B. Mollan. Microcomputer analysis of joint vibration. Journal of Microcomputer Applications 1982, 5: 287-296.